

Claims

1. A normally closed module, comprising:
a main body including a bore having a longitudinal axis associated therewith, said main body further including an armature selectively axially slidable within said bore, said main body further including a rod affixed to a first end
5 of said armature whereby said rod is axially slidable with said armature; and
a housing configured to receive a first ball, said housing including a first and a second valve seat, said first ball being selectively urged into engagement with said first valve seat, said housing further being configured to receive a second ball, said second ball selectively being urged into disengagement from said
10 second valve seat.
2. The module of claim 1 wherein said housing further includes a first port configured to cooperate with said first ball and with said second ball to selectively permit fluid flow into said module.
3. The module of claim 2 wherein said housing further includes a second port in selective communication with said first port whereby when said module is in a selectively energized state, fluid flows between said second port and said first port.
4. The module of claim 3 wherein said main body further includes a first spring disposed between said main body and said armature, whereby when said module is in a selectively energized state, said first spring forces said first ball to engage said first valve seat thereby permitting fluid flow between said second port
5 and said first port.
5. The module of claim 3 further including a magnetically-energizable coil whereby when said coil is in a selectively energized state, said armature axially magnetically moves toward said first ball, thereby forcing said first ball into engagement with said first valve seat, whereby when said first ball engages
5 said first valve seat, said first ball forces said second ball to disengage from said second valve seat to thereby permit fluid flow between said first port and said second port.
6. The module of claim 2 wherein said housing further includes a third port in selective communication with said first port whereby when said module

is in a selectively de-energized state, fluid flows between said third port and said first port.

7. The module of claim 6 wherein said housing further includes a second spring disposed between said main body and said second ball, whereby when said module is in a selectively de-energized state, said second spring forces said second ball to engage said second valve seat thereby permitting fluid flow between said first port and said third port.

8. The module of claim 7 further including a magnetically-energizable coil whereby when said coil is in a selectively de-energized state, said second spring axially force said second ball to engage with said second valve seat, whereby when said second ball engages said second valve seat, said second ball disengages said first ball from said first valve seat thereby permitting fluid flow between said third port and said first port.

9. The module of claim 1 wherein said housing further includes a first well having at least one axially-extending flute to inhibit non-axial movement of said first ball within said first well.

10. The module of claim 1 wherein said housing further includes a second well having at least one axially-extending flute to inhibit non-axial movement of said second ball within said second well.

11. A 3/2 normally closed module, comprising:
a main body including a bore having a longitudinal axis
associated therewith, said main body further including an armature selectively axially
slidable within said bore, said main body further including a rod affixed to a first end
5 of said armature whereby said rod is axially slidable with said armature; and
a housing configured to receive a first ball, said housing
including a first and a second valve seat, said first ball being selectively urged into
engagement with said first valve seat, said housing further being configured to receive
a second ball, said second ball being selectively being urged into disengagement from
10 said second valve seat, said housing further including a control port configured to
cooperate with said first ball and said second ball to selectively permit fluid flow into
said module, said housing further including a supply port in selective communication
with said control port whereby when said module is in a selectively energized state,
fluid flows between said supply port and said control port, said housing further
15 including an exhaust port in selective communication with said control port whereby
when said module is in a selectively de-energized state, fluid flows between said
exhaust port and said control port.

12. The module of claim 11 further including a magnetically-
energizable coil whereby when said coil is in a selectively energized state, said
armature axially magnetically moves toward said first ball, thereby forcing first ball
into engagement with said first valve seat, whereby when said first ball engages said
5 first valve seat, said first ball axially forces said second ball to disengage from said
second valve seat to thereby permit fluid flow between said control port and said
supply port.

13. The module of claim 11 further including magnetically-
energizable coil whereby when said coil is in a selectively de-energized state, a
second spring, disposed between said housing and said second ball, axially forces said
second ball to engage with said second valve seat, whereby when said second ball
5 engages said second valve seat, said second ball disengages said first ball from said
first valve seat thereby permitting fluid flow between said control port and said
exhaust port.

14. The module of claim 11 whereby said housing further includes a first bearing well having at least one axially-extending flute to inhibit non-axial movement of said first ball within said first bearing well.

15. The module of claim 11 whereby said housing further includes a second bearing well having at least one axially-extending flute to inhibit non-axial movement of said second ball within said second bearing well.

16. A normally closed module, comprising:
main body means including a bore having a longitudinal axis associated therewith, said main body means further including armature means selectively axially slidable within said bore, said main body means further including
5 rod means affixed to a first end of said armature means whereby said rod means are axially slidable with said armature means; and
housing means including a first well configured to receive first ball means, said first ball means being axially movable within said first well, said first well further including first valve seat means, said first ball means being selectively
10 urged into engagement with said first valve seat means, said housing further including a second well configured to receive second ball means, said second ball means configured to be axially movable within said second well, said second well further including second valve seat means, said second ball means being selectively urged into engagement with said second valve seat means.

17. The module of claim 16 further including actuation means whereby when said actuation means are in a selectively energized state, said first ball means are forced into engagement with said first valve seat means, thereby disengaging said second ball means from said second valve seat means, permitting
5 fluid flow between a first port and a second port.

18. The module of claim 16 further including actuation means whereby when said actuation means are in a selectively de-energized state, said second ball means is engaged with said second valve seat means, thereby forcing said first ball means to disengage from said first valve seat means, permitting fluid flow
5 between a first port and a third port.

19. The module of claim 16 whereby said housing means further include a first bearing well having axially-extending flute means to inhibit non-axial movement of said first ball means within said first bearing well.

20. The module of claim 16 whereby said housing means further include a second bearing well having axially-extending flute means to inhibit non-axial movement of said second ball means within said second bearing well.